CLAIMS

What is claimed is:

1. A contactless sheet resistance measurement apparatus for measuring sheet resistance comprising:

   means for illuminating the area of semiconductor structure with intensity modulated light;

   means for detecting SPV signals inside and outside said illumination area optically coupled to said illuminating means; and

   means for measurement of said SPV signals inside and outside the illumination area connected to said means for detecting SPV signals.

2. A contactless sheet resistance measurement apparatus for measuring the sheet resistance of claim 1, wherein said illumination means comprises a light emitting diode with a driver forming the sinusoidal illumination and an optical fiber directing the light onto the wafer surface.

3. A contactless sheet resistance measurement apparatus for measuring the sheet resistance of claim 1, wherein said means for detecting of SPV signals comprises a transparent conducting electrode optically coupled with a light source used for detecting SPV signal inside the illumination area and a non transparent electrode used for detecting SPV signal outside the illumination area.

4. A contactless sheet resistance measurement apparatus for measuring the sheet resistance of claim 3, wherein said transparent conducting electrode is a glass or quartz disk with ITO coating and the non transparent electrode is metal ring coaxially installed to said glass or quartz disk.

5. A contactless sheet resistance measurement apparatus for measuring the sheet resistance of claim 3, wherein said transparent and conducting electrode is a glass or quartz disk with an ITO coating and the non transparent electrode is a part of the metal ring coaxially installed to said glass disk.

6. A contactless sheet resistance measurement method, comprising the steps of:

illumination of the area of the semiconductor structure with known sheet resistance through a transparent electrode with intensity modulated light;

measurement of the SPV signal from the transparent electrode;

adjustment of the light flux to obtain linear dependence of the SPV signal versus light flux;

measurement of SPV signals *Vs0*;

measurement of SPV signal *Vs1* at the same conditions for wafer with unknown Rs; and

determination of the sheet resistance using measured *RATIO=Vs1/Vs0*, and the calculated curve or table *RATIO(Rs)*.

7. A contactless sheet resistance measurement method, comprising the steps of:

illumination the area of the semiconductor structure through a transparent electrode with intensity modulated light at maximum frequency corresponding to bandwidth of SPV preamplifier and lock-in amplifier;

measurement of the SPV signal, *Vs1,* from the transparent electrode;

adjustment of the light flux to get linear dependence of the SPV signal, *Vs1,* versus light flux;

measurement of SPV signals, *Vs1* and *Vs2*;

adjustment of light modulating frequency to get the ratio of SPV signals *RATIO=Vs1/Vs2<5* and measurement of *Vs1* an*Vs2* at this frequency; and

determination of the sheet resistance using measured *RATIO=Vs1/Vs2*, and the calculated curve or table *RATIO(Rs).*

8. A contactless method for measuring of sheet resistance and conductance of a p-n junction, comprising the steps of:

illumination the area of the semiconductor structure through a transparent electrode with intensity modulated light at maximum frequency, *F,* corresponding to a bandwidth of SPV preamplifier and lock-in amplifier;

measurement of the SPV signal, *Vs1,* from transparent electrode;

adjustment of the light flux to get linear dependence of the SPV signal, *Vs1,* versus light flux;

measurement of SPV signals and its phase shifts, *Vs1, Θ1* and *Vs2, Θ2* from transparent and non transparent electrodes;

decreasing of light modulating frequency to get the ratio of SPV signals *RATIO=Vs1/Vs2<5* and measurement of *Vs1, Θ1* and *Vs2, Θ2* at this frequency; and

determination of the sheet resistance Rs and junction conductance Gs using measured SPV signals, its phase shifts, *Vs1, Θ1* and *Vs2, Θ2* and a set of equations:

$$\frac{Vs1}{Vs2} = \left|\frac{V_{S1}}{V_{S2}}\right| = \left|\frac{1}{2}kR_0^2 \; \frac{K_1(kR_0)I_0(kR_0) + K_0(kR_0)I_1(kR_0) - (1/2kR_0)K_1(kR_0)I_1(kR_0)}{I_1(kR_0)\left[R_1 \cdot K_1(kR_1) - R_2K_1(kR_2)\right]}\right| \quad (11)$$

$$\theta_1 - \theta_2 = Arg\left[\frac{1}{2}kR_0^2 \; \frac{K_1(kR_0)I_0(kR_0) + K_0(kR_0)I_1(kR_0) - (1/2kR_0)K_1(kR_0)I_1(kR_0)}{I_1(kR_0)\left[R_1 \cdot K_1(kR_1) - R_2K_1(kR_2)\right]}\right] \quad (12) .$$